VOLUME 81 SEPARATE No. 688

PROCEEDINGS

AMERICAN SOCIETY
OF
CIVIL ENGINEERS

MAY, 1955

SANITARY FILL PRACTICE IN LOS ANGELES COUNTY

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SANITARY ENGINEERING
DIVISION

{Discussion open until September 1, 1955}

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Printed in the United States of America

Headquarters of the Society
33 W. 39th St.
New York 18, N. Y.

PRICE $0.50 PER COPY

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This paper was published at 1745 S. State Street, Ann Arbor, Mich., by the American Society of Civil Engineers. Editorial and General Offices are at 33 West Thirty-ninth Street, New York 18, N. Y.

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SANITARY FILL PRACTICE IN LOS ANGELES COUNTY

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INTRODUCTION AND DEFINITION

The cut and cover method of rubbish disposal is the officially adopted method for the unincorporated areas of Los Angeles County.

Since "cut and cover" is a rather broad classification of the land fill method of rubbish disposal, I shall describe what the term has come to mean to us in the Industrial Waste Division of the Los Angeles County Engineer's Office. To us "cut and cover" implies that excavations will be made to specified depths and at specific locations designated on an approved engineering plan. The excavated material will be stock-piled convenient to the dumping operations and will be mixed with the rubbish at a rate of about one cubic yard of earth to four cubic yards of rubbish as the rubbish is compacted by heavy bulldozer equipment (not lighter than about 21 tons). When the fill has been completed to within 2 feet of the planned finished grade, a two-foot layer of clean earth is placed over all fill surfaces to bring them to the final grade. Special precautions are taken to prevent erosion of the fills by storm runoff. The planting of quick-growing, deep-rooted cover crops on the bare, finished fill shoulders has been found to be desirable and is being included in the requirements for recently processed permits. Some of the plants that have been utilized for this purpose are mustard, wild rye, and oats.

This cut and cover method is the antithesis of the so-called "open" dump and has been adopted in preference to all others for the following reasons:

1. It eliminates the offensive features inherent with the open burning dump.
2. It is economical as compared with all other satisfactory methods, ranging in cost from 40 cents to $1.25 per ton as compared with $2.00 to $4.50 per ton by incineration.
3. It can reclaim useless or marginal lands for more useful purposes, such as public parks, recreational areas, and storage and parking areas for industrial and commercial properties.
4. It can be put into operation with a minimum of personnel and equipment.
5. It can be put into operation with a minimum of elapsed time for engineering planning when a suitable site has been secured.

SITE SPECIFICATIONS

From five years of experience and observations of cut and cover operations throughout Los Angeles County, we have developed certain basic requirements for a completely satisfactory site. These requirements are reviewed by the Regional Planning Commission, who must grant a special zoning variance for each project.

In cases of new projects we have found that it is important to get all the site preparation conditions satisfied before dumping operations begin. To

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govern this feature, a condition to that effect is put into the permit. Such items as fencing, firebreaks, water supply, access roads, and salvage yard preparation are considered as site preparation. The basic site requirements are:

1. The site must be properly located geographically to avoid conflicts with adjacent established land usages; that is, there must be room enough in the community for the facility to have a reasonable amount of isolation.
2. There must be adequate highway capacity to avoid traffic congestion which can result from the additional truck travel to and from the site.
3. The site should be located at or near the upstream boundary of the watershed on which it is located to avoid storm flow hazards.
4. There should be adequate soil on the site for mixing with compacted rubbish and for making the final coverage of the finished fill. The total amount of earth required is roughly 1/3 of the volume of the finished fill, including the final 2 feet of cover.
5. The geology and hydrology of the formation underlying the site should be such that the cuts or fills would never penetrate a usable ground water supply.

OPERATING PERMIT

When these five basic requirements have been satisfied, a zoning variance is granted and an operating permit is processed. This permit is made subject to conditions which will obtain the day-by-day operation essential to produce a satisfactory result, both immediately and ultimately. Most important factors of the operating conditions and limitations are:

1. Adequate equipment must be available on the project at all times to make the required excavations, place the rubbish in the fill, compact it, and mix earth with it as it is placed. (A 21-ton with 3-ton blade tractor is about the minimum size.)
2. An adequate and readily available supply of earth and the mixing of it with the rubbish as it is compacted is of equal importance. Its purpose is twofold, viz:
   a. Earth is the most effective means of smothering potential igniters immediately; furthermore, earth has a decided dampening effect on the accumulation of oxidation heat in the finished fill and thus reduces the probability of spontaneous combustion.
   b. The mixture of earth with the rubbish as it is compacted in about the ratio of 1 part earth to 4 parts rubbish by volume has been found to have a very marked effect upon the stabilization of a rubbish fill and reduces settlement in the finished fill to an appreciable degree. This, of course, is most essential where the finished fill will eventually serve a useful purpose.
3. Salvage operation controls are most essential to a satisfactory operation. If salvage is permitted, a designated site isolated from the main dumping area should be provided. It should also be required that all salvage operations, other than the actual retrieving and transporting of salvageable materials, should be carried on at this site.
4. An adequate water supply is essential for fire prevention and suppression. Plenty of water is also desirable for the prevention of dust and for wetting down the rubbish as it is being compacted. In fact, optimum moisture in a rubbish fill serves a similar function to that in a satisfactory highway roadbed or an earth fill dam. That is, it directly affects

the density, stability, and permeability of the finished structure. Therefore, it is our conclusion that an adequate water supply must be maintained on the project regardless of the difficulties which may be involved in obtaining it.

5. Good public relations at a dump site is important both to the operator and to the governing agency. Several factors which have a direct bearing on this feature should be mentioned. These are:
   a. Equitable and reasonable dumping fees.
   b. Truck weighing scales and a billing machine to assure the customer that he is being fairly treated with respect to his load size and charges.
   c. Adequate and dust-free access roads.
   d. Plenty of turning room at the dumping area to assure prompt and efficient attention to the customers.
   e. Pull-off service for trucks which do not have dump bodies.
   f. A wash room and toilet for the truck drivers, dump employees, and the general public.
   g. Telephone service.

The idea of weighing all rubbish materials entering and leaving the project seems to justify some discussion. Consistently measured quantities of rubbish materials placed in a fill, the volume of space occupied by such materials, and the amount of earth mixed with the rubbish are basic data for the appraisal of the quality of the final fill. Weighing the rubbish is the most feasible method of determining its quantity. Obviously the weight of salvaged materials must be determined to know the net amount of rubbish going to the fill.

To illustrate why such data are important, I shall suggest one or two situations where they are often needed. When a cut and cover dump site is placed into operation, there is an initial volumetric capacity at the site for the disposal of rubbish. If the compaction ratio is only 2, the weight of the rubbish that will be placed in a unit volume is 1/2 the amount which could be placed in the same volume if the compaction ratio were 4. Therefore, to make estimates of the dump capacities, both over-all and progressively, the weight of the material as it comes to the site and its density in place are necessary.

Another instance where data on weights of rubbish is of great assistance is in the establishment of the ratio of rubbish fill to the mix dirt which is an indicator of the stability to be expected in the fill. That is, known weights of rubbish against measurable volumes of earth used gives an excellent index to the quality of the final fill. Optimum ratios of rubbish to earth mix for maximum attainable density should be known. Reliable data on this factor are very scarce.

To explore this further, let's examine the factor of rubbish compaction and earth mixing on a theoretical basis. The weight of average rubbish, exclusive of all voids, is probably slightly greater than pine wood, that is, about 50 pounds per cu.ft. or 1350 pounds per cu.yd. Assume that the rubbish as received at the dump site weighs 300 pounds per cu.yd. On this basis, the voids in loose rubbish amount to about $78\,\%\left[\left(1-\frac{300}{1350}\right)100\right]$ of the gross volume. If the rubbish is compacted to twice its loose density, then the voids in the compacted rubbish would be about 56%, and it would weigh 600 pounds per cu.yd. Now if earth is mixed with this rubbish in the ratio of 1 of earth

to 4 of compacted rubbish, the resultant mixture would have a density of 600 pounds of rubbish plus 750 pounds of earth (using earth to weigh 3,000 pounds per cu. yd.), or 1350 pounds per cu. yd., and the voids would then be 42%. The dead load of the fill plus the final two-foot cover might reduce the over-all voids of the fil' to about 30%. After a period of ten years, the dead load of the fill plus some decomposition might reduce the voids to 20%. Therefore, in a fill 20 feet thick there might be a two-foot settlement of the top surface after the fill has been completed, since the further reduction of the voids will result largely from vertical compaction.

Now let's assume that the rubbish is placed in the fill without any special compaction operation and without earth being added. The truck traffic passing over the rubbish will probably compact it to a density of about 400 pounds per cu. yd., and the voids would be about 70% $[(1 - \frac{400}{1350}) 100]$ when the fill is finished. 2 feet of earth placed on it plus its dead weight might reduce the voids to 60%. Now after a period of ten years, decomposition plus the dead weight might further reduce the voids to the 20% mentioned in the previous case. Then in a 20-foot fill the settlement, after the fill was finished, would be 8 feet, again on the basis that the reduction of the voids would result from the vertical compaction. In addition, there would be the continuous inherent fire hazard, first, because of the larger percentage of voids to supply combustion oxygen, and second, because of the lack of earth mixed in the rubbish to serve as a snuffer. The greater settlement if fires do break out and the fact that only about 1/3 of the potential dump capacity is utilized as compared with compacted fill, indicate two very important arguments in favor of getting the maximum compaction and stability in the fills as they are being placed.

REGULATIONS AND ENFORCEMENT

Some comments relative to the enforcement phases of the subject appear to be in order.

1. Clear-cut Conditions and Limitations
   Our experiences indicate that reasonable, clear-cut conditions and limitations and specifications are essential to getting compliance with statutory requirements.
2. Faithful Performance Bond
   Another useful tool in this connection is to require the posting of a faithful performance bond by each dump operator to assure that any project, once begun, cannot be abandoned without proper attention being given to esthetic and sanitary features. In Los Angeles County this bond is a fairly simple form, and the document is deposited with the Board of Supervisors. These bonds are for various amounts, depending upon the acreage of the project involved. The minimum is for $5,000 and covers sites up to 5 acres in area. For sites larger than 5 acres, the bonds are increased at the rate of $1,000 per acre with the maximum amount fixed at $25,000.
3. Business Licenses
   In Los Angeles County all dump operators are also required to obtain an annual business license. This business license is issued by the County Tax Collector after he has been instructed by the Board of Supervisors so to do. Before such instructions are given to the Tax Collector, the Board of Supervisors requires the County Engineer to

furnish a certification relative to certain specific items which are intended to reflect the integrity, public interest, and operational ability of the applicant. Therefore, it is mandatory that the County Engineer and the Tax Collector closely coordinate their procedures in the issuance of these business licenses.

The business license fee for the operation of a dump, land reclamation project, or other waste disposal facility in Los Angeles County is $100 per year renewable prior to January 1st each year. This fee should be sufficient to cover the direct policing costs of dump inspections. However, it has been our experience that $100 per year is not sufficient.

4. Orders to Comply

In the enforcement of the dump permit conditions and limitations, we sometimes find it necessary to advise the operator in writing of the infractions observed, the action necessary to correct objectionable conditions, and the time limit to accomplish compliance. Such a notice is known to us as an "Order to Comply." When this notice is issued, a copy is given to the person in charge at the dump site, and the original is forwarded to the operator by registered mail. A copy of this order is also sent to the surety, or bondsman, of the operator. Sending of this last copy has been found to have a very sobering effect upon the operator.

SUMMARY

1. A sanitary fill made by the cut and cover method is a feasible, economical method of disposing of rubbish.
2. The intimate mixing of dirt with the rubbish in the fill as it is compacted has been found to be very effective in the prevention of fires in rubbish, and it also contributes substantially in the compaction of rubbish and the stabilization of the fill.
3. Salvage operations, if permitted at the dump site, should be firmly regulated to avoid unsightly conditions, harborage of rodents, and fire hazards. The minimum regulations should require fenced areas for stored salvage, regular scheduled dispatch of salvaged material from the dump site, and confining of all sorting, drying, and packaging of salvage to the designated salvage area.
4. Weighing scales should be included in the standard equipment for rubbish dumps to assure equitable charges to the public and to provide data for scientific control of the fill operations.
5. Land fill rubbish dumps can be operated on a relatively nuisance-free basis. Furthermore, the sites when completed may be put to beneficial uses not possible with the original land.
6. Planting of finished surfaces with quick-growing cover crop plants is highly desirable to prevent serious erosion until native plants can become established.
7. Enforcement of regulations can be materially facilitated by clear specifications including engineering plans, a reliable faithful performance bond, and a renewable business license.
8. Good public relations can be maintained by fair prices, an equitable means of determining fees, and good housekeeping at the site.

REFERENCES

1. A.S.C.E. Bulletins:
   a. Volume 80, Separate No. 473 - "Refuse Collection."
   b. Volume 80, Separate No. 474 - "Dumping and Land Fill."
2. "Report on Rubbish and Refuse Disposal for Los Angeles County," prepared by the Los Angeles County Engineer in April, 1949.

ACKNOWLEDGMENTS

Mr. William J. Fox, Los Angeles County Engineer
Mr. R. L. Gregory, Chief Deputy Los Angeles County Engineer
Mr. J. A. Lambie, Assistant Chief Deputy Los Angeles County Engineer
Mr. Arthur Pickett, Industrial Waste Engineer, Office of Los Angeles County Engineer